

HISTOLOGICAL STUDY OF THE DIGESTIVE TRACT OF *DASYPUS HYBRIDUS* AND *ZAEDYUS PICHYI* (MAMMALIA, DASYPODIDAE)

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ABSTRACT

The histomorphology of the digestive tract of the armadillos *Dasyopus hybridus* (Desmarest, 1804) and *Zaedyus pichyi* (Desmarest, 1804) was studied. It is similar to that of monogastric mammals. As in *ChaetophRACTUS villosus* (Desmarest, 1804) and *C. vellerosus* (Gray, 1865) there is a caecum between the small and the large intestine. The pancreas of *D. hybridus* presents islets of Langerhans with irregular shape; in *Z. pichyi* they are round.

KEYWORDS: Armadillos, histology, digestive tract, mammals.

INTRODUCTION

Dasyopus hybridus (Desmarest, 1804) and *Zaedyus pichyi* (Desmarest, 1804) are south american mammals very common in Argentina. *D. hybridus* is also found in Paraguay, Uruguay and in the south of Brazil (TALMAGE & BUCHANAN, 1954). *Z. pichyi* also lives in Chile (CABRERA, 1958). According to REDFORD (1985), *Zaedyus* is carnivorous-omnivorous and *Dasyopus* insectivorous.

The literature dealing with histomorphological aspects of the digestive tract of the armadillos is scarce (GRASSE, 1955; RIET CORREA *et al.*, 1965; ESTECONDO *et al.*, 1995). CUBA CAPARO (1979) partially studied *Dasyopus hybridus*. We present the histology of the digestive tract of *Zaedyus pichyi* and *Dasyopus hybridus*.

MATERIAL AND METHODS

Adult animals of both sexes, from Bahía Blanca area, Buenos Aires, Argentina, were anesthetized with sodium tiopentone (i.p.), perfused with Bouin's fluid, dehydrated, embedded in paraffin and sectioned at 5-7

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µm thickness. Sections were stained with hematoxylin and eosin, Masson's trichrome, Azan of Heidenhein and peryodic acid Schiff's reaction. The microscopic slides are deposited in the laboratory of Animal Histology of the Universidad Nacional del Sur, Bahía Blanca.

RESULTS

The mucosa of the esophagus of *Dasyus hybridus* and *Zaedyus pichyi* has longitudinal folds, that allow the expansion of the organ, they are covered by stratified unqueratinized squamous epithelium (fig. 1, e) that becomes thicker toward the passage to the stomach; lamina propria (lp) of dense connective tissue. Toward the posterior half of the esophagus begins to appear smooth muscle fibers of longitudinal arrangement belonging to the muscularis mucosae (mm). The submucosa (s) penetrates in the mucosal folds; it is made up of loose connective tissue with a great number of blood vessels and mucous acini (ma). The muscular layer is formed by striated muscle fibers and consists of two layers, internal circular and external longitudinal. In the posterior portion of the organ smooth muscle fibers begin to be intermixed within the circular layer. The adventitia consists of loose connective tissue, covered by a single layer of squamous epithelium. In the gastro-esophageal junction, the squamous stratified epithelium is replaced by a simple cylindrical one. The muscular is composed by two smooth muscle layers. The internal with circular arrangement, widens forming a sphincter. The external is longitudinal.

The mucosa of the stomach is lined with a simple columnar epithelium, tall, surmounted by a top plate. The corion, scarce, is found among the gastric glands. The glands are simple tubular with three different types: (1) cardial glands, restricted to the cardial region of the stomach, they are coiled and formed by mucous cells; (2) fundic glands (fig. 2, fg), the most abundant, constituted by the four characteristic cellular types of mammals: surface epithelial cells, mucous neck cells, chief or zymogen cells and parietal or oxintic cells; (3) piloric glands (fig. 3, pg), restricted to the final portion of the stomach, they are constituted by mucous cells.

The muscularis mucosae constituted by smooth muscle fibers with longitudinal arrangement, is observed between the corion and the submucosa. From the corpofundic portion of the stomach, the muscularis mucosae is formed by two smooth muscle layers. From the inner circular one, run fibers that penetrate among the glands; the outer layer is constituted by longitudinal fibers. This arrangement remains throughout the digestive tract.

The submucosa is made of loose connective tissue highly vascularized. The muscular layer is formed by smooth muscular fibers arranged in two layers, the inner circular and the exterior longitudinal. The last one is more prominent toward the piloric portion of the stomach. Outside of the muscle layer there is the serosa of loose connective tissue, covered by a single layer of flattened mesothelial cells. A muscular sphincter separates the stomach from the small intestine.

The small intestine can be divided in three regions, duodenum, jejunum and ileum. There are folds formed by mucosa and submucosa and villi (fig. 4, v), that included only the mucosa layer. Invaginations of the epithelium constitute the glands of Lieberkühn. The epithelium that covers the mucosa consists of a single layer mainly composed of

columnar absorptive cells with striated border. Among these cells there are goblet cells that increase in number toward the caecum. The lamina propria is narrow and made up of loose connective tissue. The fibers of the inner layer of the muscularis mucosae penetrate in the villi and between the glands. The submucosa layer, composed of loose connective tissue highly vascularized, form the core of the mucosal folds. The muscular layer is made up of smooth muscle with typical arrangement. The serosa of loose connective tissue is covered by a mesothelium.

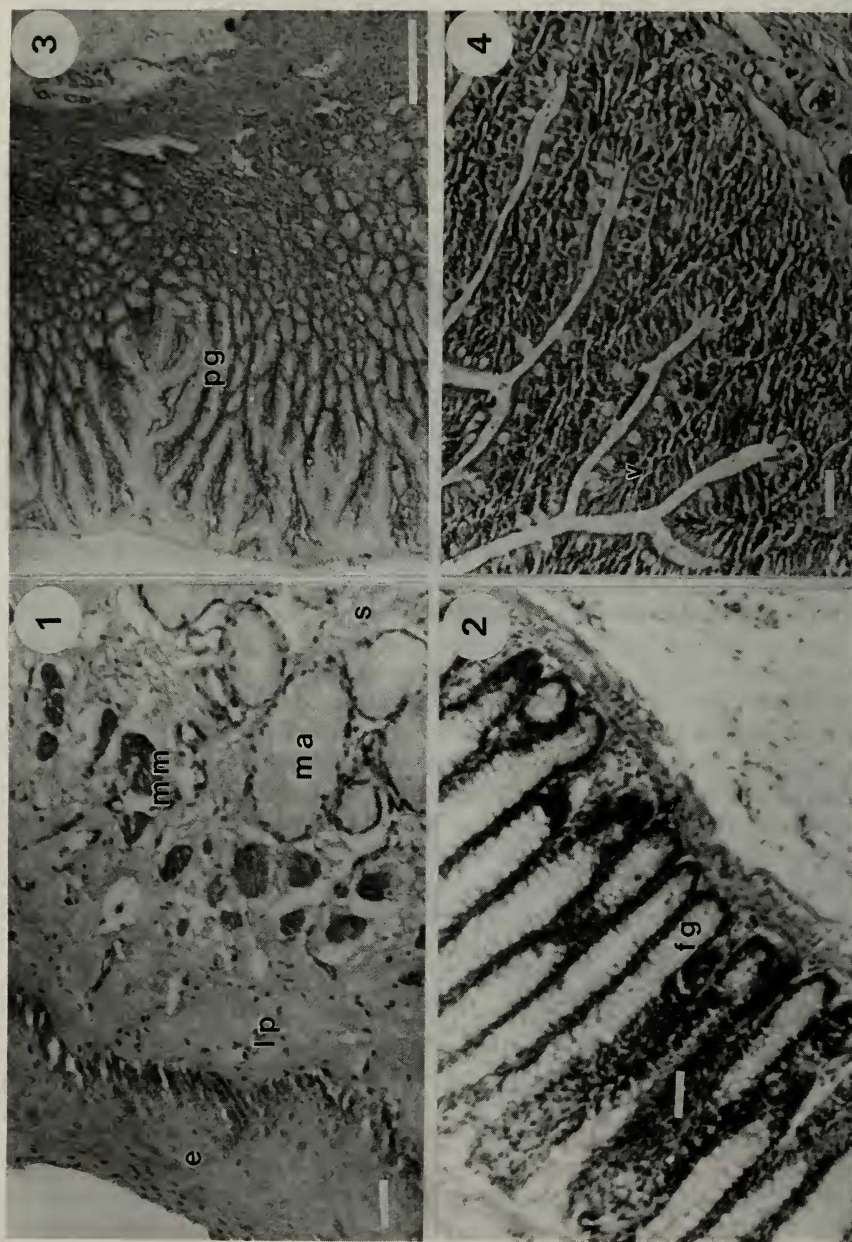
In the duodenum the villi are shorter than in the jejunum and ileum, and there are glands of Brünner in the submucosa. In the jejunum and ileum there are more goblet cells than in the duodenum, there are no glands of Brünner and the submucosa is thinner. There are lymphatic nodules in the corion and in the submucosa. Between the small and the large intestine there is a caecum. In the passage from the small intestine to the caecum there is a muscular sphincter. The caecum differs from the small intestine because it has no villi (fig. 5). Mucosa, submucosa, muscular and serosa present characteristic arrangement. Between the caecum and the large intestine there is no muscular sphincter.

Histologically the large intestine (fig. 6) resembles the caecum. The epithelium (e) is made up of a single layer of columnar cells with striated border. The goblet cells increase in number toward the rectum. The rectum (fig. 7) is histologically similar to the large intestine. Nevertheless the external muscular layer is thicker than the inner one. In the transition from the rectum to the anal region the epithelium becomes stratified squamous. A few distance from this passage, it becomes queratinized.

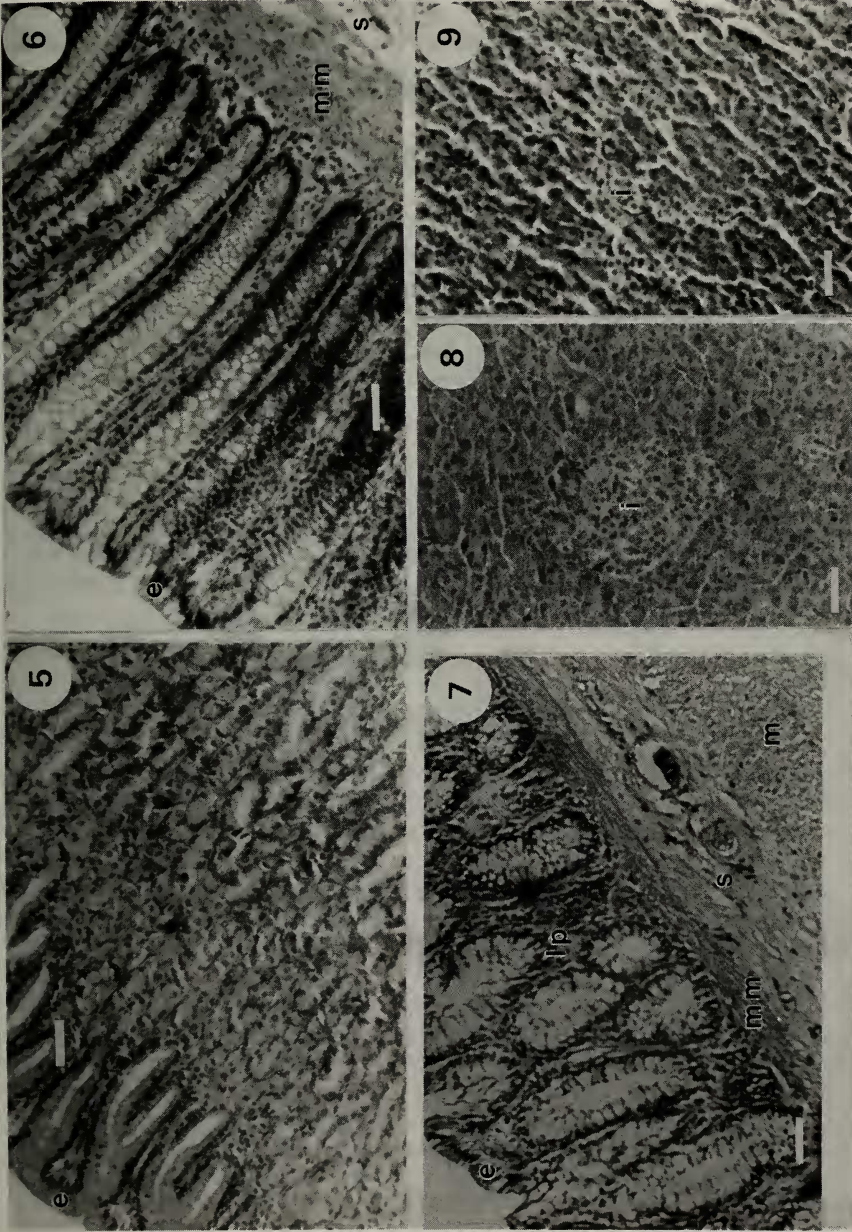
The liver, the gall bladder and the exocrin portion of the pancreas present the typical histological structure found in mammals. The islets of Langerhans (i) are round in *Z. pichyi* (fig. 8). In *Dasyus* they are irregular in form and size (fig. 9).

DISCUSSION

The digestive tracts of *Z. pichyi* and *D. hybridus* are histologically very similar and are comparable to those of *Chaetophractus villosus* (Desmarest, 1804) and *C. vellerosus* (Gray, 1865); (ESTECONDO et al., 1995). They have all the typical monogastric mammals structure. As was suggested for *C. villosus* and *C. vellerosus* (ESTECONDO et al., 1995), the sphincter that separates the caecum from the small intestine might participate in the regulation of the intestinal flow. CUBA-CAPARO (1979) indicates the presence of a caecum with villi in *D. hybridus* and observed in this organ the presence of tubular glands similar to those of the gastric cardial region. According to our observations, the caecum of *Z. pichyi* and *D. hybridus* are histologically similar to the large intestine but none of the two organs presents villi or cardial like glands. The pancreas of *Z. pichyi* resembles that of *C. villosus* (ESTECONDO et al., 1995). The pancreas of *Dasyus hybridus* is comparable to that of *C. vellerosus* (ESTECONDO et al., 1995) and to that of *D. septemcinctus* (Linnaeus, 1758) (RIET-CORREA et al., 1965).



Figs. 1-4. *Zacodyus pichyi*: 1, esophagus, transversal section (Masson). *Dasypus hybridus*: 2, fundic glands of the stomach (Masson). *Z. pichyi*: 3, pyloric glands (Masson). 4, general view of the small intestine (Masson). (e, epithelium; fg, fundic glands; lp, lamina propria; ma, mucous acini; mm, muscularis mucosae; pg, pyloric glands; s, submucosa; v, villi). Bars: fig. 3, 100 μ m; figs. 1, 2, 4, 60 μ m.



Figs. 5-9, *Dasypus hybridus*: 5, general view of caecum (Masson). 6, large intestine (Masson). 7, rectum (Masson). 8, pancreas (Masson). 9, pancreas (Masson). (e, epithelium; i, islets of Langerhans; mm, muscularis mucosae; s, submucosa). Bars: figs. 5-9, 60 μ m.

REFERENCES

- CABRERA, A. 1958. Catálogo de los mamíferos de América del Sur. **Revta Mus. argent. Cienc. nat. Bernardino Rivadavia**, Buenos Aires, 4: 1-307.
- CUBA-CAPARO, A. 1979. **Atlas de histología del armadillo de 7- bandas *Dasybus hybridus***. Buenos Aires. Panamerican Center of Zoonosis, OPS/OMS. 166 p.
- ESTECONDO, S.; CODÓN S. M. & CASANAVE, E. B. 1995. Histología del tracto digestivo de *Chaetophractus villosus* (Desmarest, 1804) y *C. vellerosus* (Gray, 1865) (Mammalia, Dasypodidae). **Iheringia, Sér. Zool.**, Porto Alegre, (78): 9- 18.
- GRASSE, P.P. 1955. Ordre des Edentes. In: GRASSE, P.P. ed. **Traité de Zoologie**. Paris. Masson. v. 17, p. 1182-1266.
- REDFORD, K.H. 1985. Food habits of armadillos (Xenarthra: Dasypodidae). In: MONTGOMERY, G. G. ed. **The evolution and ecology of Armadillos, Sloths and Vermilinguas**. Washington, Smith. Inst. p. 429-437.
- RIET-CORREA, P.; MARQUES, M. & HAASE, H. 1965. Pancreas extractable insulin and islets structure of the armadillo *Dasybus septemcinctus*. **Revta bras. Biol.**, Rio de Janeiro, 25 (3): 249-252.
- TALMAGE, R. V. & BUCHANAN, G. D. 1954. The armadillo *Dasybus novemcinctus*. **Rice Inst.**, Pamphlet, 41: 1-135.